The Relationship between Speed of Processing and White Matter Integrity in Secondary Progressive Multiple Sclerosis: a VBM and TBSS Study.

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Objective.

This study aimed at investigating: the relationship between WM integrity and processing speed (PS) performance, and the PS-dependent relationship between WM integrity and higher order cognitive functions in patients with SPMS.

Background.

Secondary progressive multiple sclerosis (SPMS) is a neurodegenerative disease in which patients develop grey and white matter (GM, WM) degeneration and cognitive impairment, including PS deficits. However, the relationship between WM integrity and PS has yet to be clarified.

Methods.

Thirty one patients with SPMS (mean age, 52.5 years; mean disease duration, 15.5years; mean EDSS, 6.4) had detailed neuropsychological assessment (Trail Making Test A, Stroop test, Digit Cancellation, category and letter fluency). A PS index was computed by combining TMT-A, Stroop speed, and Digit Cancellation. T1-weighted and diffusion weighted MR images were acquired. Voxel-based morphometry (VBM) and tract-based spatial statistics (TBSS) techniques were used to investigate: the correlations between WM/GM measures and cognitive variables; and the differences in WM/GM measures between high (HP) and low performers (LP) divided on the bases of the PS index.

Results.

VBM analysis showed that only the PS index and timed fluency tasks correlated with left-lateralised WM tracts. Moreover, the HP subgroup had more WM than LP in the same WM tracts. Consistent results were found for fractional anisotropy (FA) in the TBSS analysis: correlations were seen mainly in a wide network of associative tracts only for PS-dependent tests. Furthermore, HP showed higher FA and lower mean diffusivity than LP in similar WM tracts: namely the left superior longitudinal fasciculus and left inferior fronto-occipital fasciculus.

Conclusions.

In SPMS, PS relies on WM rather than GM integrity as does performance in PS-dependent higher order cognitive functions. WM associative tracts supporting fast integration of information across the brain seem to be crucially involved in tasks requiring effective management of time.